

Atomic structure and periodic table

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Atoms

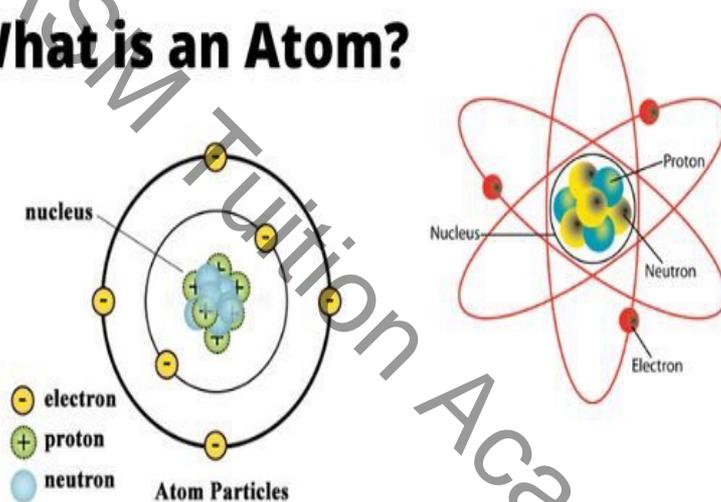
Structure of the atom

- Atoms are really tiny particles- even to see atom we use Microscope
- Atoms have radius of about 0.1 nano meter (1×10^{-10} m)
- It consist of 2 main things

1- Nucleus

2- Sub atomic particles

What is an Atom?



1. Nucleus:

- It is present in the middle of the atom
- It contains protons and neutrons inside the nucleus.
- The diameter of nucleus is (1×10^{-14} m) is less than of the radius of an atom

2. Sub- atomic particles

- Sub- atomic particles are 3 particles which are present inside the nucleus and outside the nucleus

C2: Atomic structure

And Periodic table

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Protons and neutrons:

- Inside the nucleus Protons and neutrons are present.
- Protons have +ve charge and neutrons have no charge. Due to protons the charge of nucleus is +ve

Electrons:

- Electrons are the subatomic particles that move around the nucleus in electron shells or orbits
- They are -ve charged particles
- Volume of an atom determines the size of an atom
- Electrons have negligible mass

| Subatomic Particle | Relative Charge | Relative Mass |
|--------------------|-----------------|---------------------|
| Proton | 1 | 1 |
| Neutron | 0 | 1 |
| Electron | -1 | Negligible (1/2000) |

Fig 1. Relative Masses and Charges of Subatomic Particles.

Number of protons is Equal to Number of Electrons

- Atoms are neutral because in an atom the number of protons is equal to the number of electrons, but having opposite charges, so +ve charge and -ve charge cancel each other out.

No of protons = no of electrons

- In an **ion**: no# of protons are not equal to no# of electrons

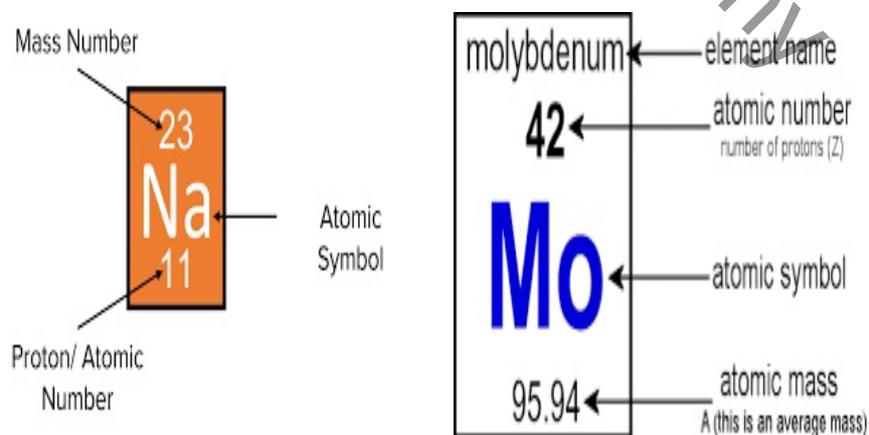
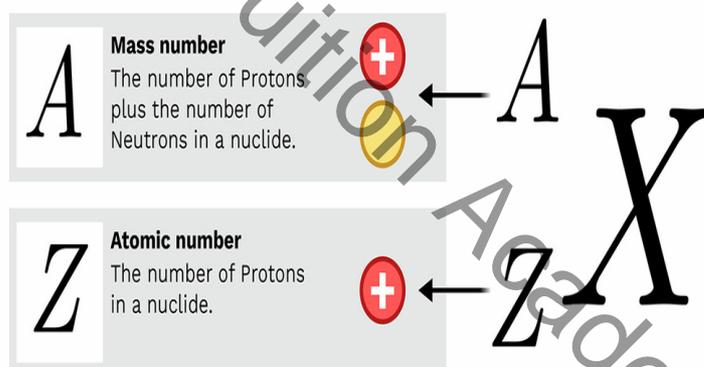
For example: in an ion with -2 charge has 2 more electrons than protons

Atomic number

- **Definition:** The number of protons in an atom of an element is its atomic number.
 - all atoms of a given element have the same number of protons
 - atoms of different elements have different numbers of protons
- **For example,** the atomic number of sodium is 11. Every sodium atom has 11 protons and 11 electrons. It has 11 positive charges and 11 negative charges.

Mass number

- **Definition:** The total number of protons and neutron in an atom is called Mass number.
- **For Example:** Atoms of different elements usually have different mass numbers, but they can be the same. For example, the mass number of argon atoms and calcium atoms can both be 40.



Calculating numbers of subatomic particles

To calculate the numbers of subatomic particles in an atom, use its atomic number and mass number:

- number of protons = atomic number
- number of electrons = atomic number
- **number of neutrons = mass number - atomic number**



Q: The atomic number of a sodium atom is 11 and its mass number is 23. Calculate the number of protons, neutrons and electrons it contains.

Solution:

As number of protons is called Atomic number and number of protons and no of electrons are equal so the

Number of proton= 11

Number of electrons = 11

Number of Neutrons= = mass number - atomic number

$$= 23 - 11 = 12$$